Light and Lighting

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New Lighting in Old Buildings

IT may be bad policy to put new wine in old bottles, but it is often inevitable to put new lighting into old buildings.

This subject was discussed at a recent joint meeting of the R.I.B.A. and the I.E.S. (See page 193).

In some cases the change can be made with comparatively little difficulty, but in others new fittings appear incongruous. It is then surely permissible to conceal new lamps in fittings of antique appearance. To some the very thought of thus imitating old things gives offence. Yet the effect of some degree of harmony thus achieved is surely better than frank juxtaposition of the new and the old.

Be it noted that the problem is not only one of suitable fittings. The very nature of modern lighting—the high illumination and the diffusion of the light—may be foreign to an interior of period design. It then becomes necessary to weigh competing claims—whether to meet fully the needs of operations conducted in the room or to preserve its atmosphere—leaning to the latter if the uses to which the room is usually put make no very severe demands upon the eyes.

"The West's Awake"

These words from the old song might well be applied to the I.E.S. Centres in the West Country, which are showing much activity just now. On November 1 the president paid a visit to the Bath and Bristol Centre, at whose initial meeting of the session the presidential address was repeated. This meeting was preceded by a luncheon. Here the centre scored definitely by securing the presence of the mayors of the two cities concerned, both of whom responded to the toast of the corporations, which was moved by Mr. L. C. Rettig, the chairman of the centre, who presided. The toast of the society was moved by Mr. A. N. Irens, chief electrical engineer to the Bristol Aeroplane Company, who strongly emphasised the value of good lighting to the community. The president (Mr. J. S. Dow) responded.

In the interval between the luncheon and the evening meeting visitors were afforded an opportunity of seeing an exhibition, on a modest scale but excellently arranged. All three events took place at the Grand Hotel. There was a representative display of fluorescent lamps and exhibits illustrating their properties and applications. A new item here was a fluorescent lamp so controlled that by turning a knob its brightness could be varied within wide limits. It would seem that the new lamp is at a distinct advantage here as compared with filament lamp for the efficiency presumably diminishes much less rapidly as the light is extinguished—in fact, one seems to approach the unique advantage of the flat flame gas burner of being able to effect a material saving by "turning down the light" freely at will. Other features were a chart recording all papers and other contributions at meetings of the centre and a neatly executed banner inscribed with the title of the society, the arms of the two cities, Bath and Bristol, and the familiar I.E.S. emblem executed in black and gold.

The other Western centre, linked to Gloucester and Cheltenham, is also making a start, with flying colours, on December 3, when Mr. J. G. Applebee is to lecture on stage lighting in the Cheltenham Town Hall. A large attendance is expected, and it is hoped that the president will again be present.

Forthcoming I.E.S. Meetings

(Provisional List)

SESSIONAL MEETINGS IN LONDON

1946.

Dec. 10th. MR. A. CUNNINGTON and MR. G. W. GOLDS on **Railway Lighting. Some Lessons from Experience and Views on the Future.** (*At the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2.*) **6 p.m.**

Jan. 14th. DR. W. D. WRIGHT on **Colour in Illuminating Engineering.** (*At the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2.*) **6 p.m.**

MEETINGS OF CENTRES AND GROUPS

1946.

Dec. 2nd. MR. W. J. G. DAVEY on **"Nomograms."** (*At the Sheffield University, Western Bank, Sheffield.*) **6 p.m.**

Dec. 3rd. MR. L. G. APPLEBEE on **Coloured and Directional Light as Applied to the Theatre.** (*At Cheltenham Town Hall.*) **7 p.m.**

Dec. 3rd. MR. W. J. G. DAVEY on **Short Cuts in Illuminating Engineering—Latest Developments.** (*At the Electricity Showrooms, Market Street, Huddersfield.*) **7 p.m.**

Dec. 4th. MR. H. L. JAMES on **The History and Development of Lighting.** (*At the Minor Durant Hall, Oxford Street, Newcastle-upon-Tyne.*) **6.15 p.m.**

Dec. 5th. MR. C. S. CHUBB on **Improvements in Mine Lighting.** (*Joint meeting with the S.W.I.E. and A.I.M.I.E.E. At the South Wales Institute of Engineers, Cardiff.*) **6 p.m.**

Dec. 5th. MR. F. M. HALE on **The Operation of Street and Traffic Control Lighting.** (*At the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow, C.3.*) **6 p.m.**

1946.

Dec. 6th. MR. W. T. F. SOUTER on **The Lighting of Public Buildings.** (*At the Electricity Showrooms, Bath.*) **7 p.m.**

Dec. 6th. DEBATE: **Can the I.E.S. Code be profitably applied to Industry.** (*At the Imperial Hotel, Temple Street, Birmingham.*) **6 p.m.**

Dec. 6th. Joint meeting with the Royal Scottish Society of Arts. (*At Edinburgh.*)

Dec. 6th. MR. W. D. SINCLAIR on **The Lighting of Public Highways.** (*At the City of Nottingham Gas Dept. Demonstration Theatre, Parliament Street, Nottingham.*) **5.30 p.m.**

Dec. 10th. MR. T. O. FREETH on **Domestic Lighting.** (*Joint meeting with the Electrical Association for Women. At the Corporation of Leicester Electricity Dept., Demonstration Theatre, Charles Street, Leicester.*) **6.30 a.m.**

Dec. 10th. DR. J. H. NELSON on **Colour in Industry.** (*At the Liverpool Corporation Electricity Showrooms, Whitechapel, Liverpool.*) **6 p.m.**

Dec. 12th. DR. J. H. SHAXBY on **Colour and the Eye.** (*Joint meeting with the Institute of Physics, Manchester and District Branch. At the Reynolds Hall, College of Technology, Sackville Street, Manchester.*) **6 p.m.**

1947.

Jan. 2nd. MR. E. H. PENWARDEN and MR. S. ANDERSON on **New Lighting for Old Buildings.** (*At Gloucester.*) **7 p.m.**

Jan. 3rd. MR. D. C. JAMES on **Store and Display Lighting.** (*At Radiant House, Bristol.*) **7 p.m.**

Jan. 3rd. DR. J. H. NELSON on **Industrial Decoration.** (*At the Imperial Hotel, Temple Street, Birmingham.*) **6 p.m.**

Jan. 3rd. Four 15-minute papers on **Lighting as Applied to:**

1. **Churches,** by MR. C. S. CAUNT.
2. **Drawing Offices,** by MR. A. S. HACKMAN.
3. **Hospitals,** by MR. E. G. PHILLIPS.
4. **Schools,** by MR. N. C. SLATER.

(*At the City of Nottingham Gas Dept Demonstration Theatre, Parliament Street Nottingham.*) **5.30 p.m.**

(Secretaries of Centres and Groups are requested to send in particulars of any changes in programmes, mentioning subject, author, place, date and time of meeting; summaries of proceedings at meetings (which should not exceed about 250–500 words) and any other local news are also welcome.)

Lectures on Light and Vision

In addition to formal courses in illuminating engineering, such as those intended to prepare students for the City and Guilds Examination, there is always room for short series and occasional lectures, which in general command good support. We have before us two cases in point, the special lectures on illumination which are being given by Mr. J. M. Waldram at the Sir John Cass Technical Institute (Jewry-street, London, E.C.3), and the series on the Physiology of Vision, by Professor H. Hartridge, at the Gresham College (Basinghall-street, London, E.C.2).

Mr. Waldram's weekly lectures, commencing on November 20, cover The Eye and Seeing, Recent Electric Lamps, Illumination Problems, Design of Lighting Equipment, and Recent Photometric Apparatus.

Professor Hartridge's four lectures (given at 5.30 p.m. on November 4, 5, 6, and 7) entered very fully into the nature of the human eye and its reactions to light. Admission to the Gresham lectures was free, whilst for Mr. Waldram's series only the modest fee of ten shillings is asked.

B.S.I. Specifications

Particulars have reached us of two important specifications recently issued by the British Standards Institution. The Schedule for Electric Discharge Lamps for General Purposes (1270 : 1946) is, we believe, the first to deal with this type of electric lamp. The schedule comprises two tables the first covering rating and dimensions, and the second wattage, efficiency and life. The types represented include mercury, mercury fluorescent, mercury tubular fluorescent and sodium lamps; so that a wide and diverse range is represented. The initial lumens per watt range from 21 to 71.5—the higher figure being attained with sodium lamps, and the average life from 2,000 to 3,000 hours.

The second specification (1332 : 1946) is described as the British Standard Guide to Civil Land Aerodrome Lighting and is a revision of previous efforts in 1932, 1934 and 1937, which naturally were in need of modification owing to subsequent developments. In civil air transport 24-hour operation is essential. In spite of the possibilities of radar ground lighting remains valuable and the guide, which is limited to visual aids, gives a general explanation of the lights that pilots will see from above.

Both specifications are available from the British Standards Institution, Publications Dept., 28, Victoria-street, London, S.W.1, at a price of 2s. post free.

The Paper Problem

It is interesting to observe that the American I.E.S. has approved a recommendation whereby future issues of *Illuminating Engineering* will be printed on a lower quality of paper and in double column format. To those of us who have noted with envy the freedom which journals in the U.S.A. enjoy from paper restrictions, this announcement may cause some surprise; but we gather that the change is based on economy rather than shortage of paper.

The change in format raises a very interesting and debatable point Oddly enough the I.E.S. in this country is at present making an experimental change in the reverse direction, i.e., it is adopting for formal papers the single column format similar to that hitherto used in *Illuminating Engineering* and is discarding the double column arrangement except for supplementary notes.

Both methods have advantages but also drawbacks.

New Lighting for Old Buildings

Summary of a paper read at a Joint Meeting of the Royal Institute of British Architects and the Illuminating Engineering Society, held in London, on November 6th, 1946.

In commencing their paper, the authors pointed out that modern lighting standards of illumination have advanced to such an extent that the public is becoming critical of the subdued lighting formerly accepted as adequate in many buildings of historic interest. The paper, therefore, deals with problems involved in the introduction of modern lighting in old buildings. With old installations wide variations in illumination are found as one passes from room to room—sometimes mitigated by the use of supplementary lighting devices (pendants, table lamps, brackets, etc.). Such devices may, however, do much to spoil the appearance of a fine room.

The requirements in lighting an artistic interior depend on various factors, such as the nature of the decoration. Better distribution of light is often needed to reveal the beauty of an interior, and better rendering of colour values may have a lot to do with the appearance of coloured objects (old fabrics, china, tapestries, etc.). This colour rendering is best obtained directly, as in the case of the fluorescent lamp, rather than by subtractive methods which are necessarily uneconomical. Experience has shown, however, that even when the desired colour of the light source is attained a relatively high illumination is often necessary in order to reveal colours appropriately. Equally important are the effect of the lighting on texture and the choice of a method of lighting giving the correct shadow conditions.

One consideration which is assuming increasing importance is the use of artificial light to supplement daylight. Here again the new modes of lighting, which can be brought into close resemblance to daylight, present great advantage. It must also be remembered that daylight itself varies from day to day and even from hour to hour, whereas a system of artificial light, once correctly installed, remains constant.

Following out these ideas the authors next entered into a summary of the characteristics of tungsten filament lamps, fluorescent lamps and cold cathode fluorescent tubes, methods of light control, and the choice of translucent materials (glass, perspex, aluminium, etc.).

In discussing types of buildings a distinction was drawn between (1) old buildings of historic interest requiring improved lighting and (2) old buildings of later period requiring modern standards of illumination. Both classes present special problems—amongst them being the dark and sombre backgrounds often found which are apt to result in excessive brightness contrasts—and the design of fittings to harmonise with period interiors.

Of the many possible and alternative methods of treatment the authors mention (a) the adaptation of existing fittings to take new lamps and light control equipment; (b) the installation of new fittings specially designed in appropriate style; (c) the use of modern fittings of simple exterior design, and (d) the addition of light from concealed sources.

In the concluding portion of the paper numerous illustrations, some showing actual installations, other conjectured designs, were exhibited, and the special technical points involved were discussed in detail.

The Earliest Street Lighting with Arc Lamps?

We are indebted to Mr. A. P. Trotter, whose own recollections of electric lighting go back to very early days, for a most interesting letter written by Alexander Siemens on May 12, 1910, describing what is believed to be the first installation of street lighting with arc lamps in this country—introduced in the City of London early in 1881. Particulars of the installation are given in this letter, reproduced below. The account of the calculations on the last page reminds us that methods of predetermining illumination were familiar and practised—even more than 60 years ago!

ALEXANDER SIEMENS

TELEPHONE GERRARD 6811.

TELEGRAPHIC ADDRESS: ALEXANDER CARE SIEMENS LONDON

Caxton House,
Westminster,
London, S.W. 12th May 10.

Dear Trotter,

In reply to your letter of the 10th inst I find from some records at this office, that our lighting in the City was to have been started on the 1st Jan: '81, and I believe it was actually started about that time — (continuous current).

We had 6 lights of about 30 amps on poles 80 feet high and I think about 50 of 12 amps: alternating: on poles 20 feet high —

In both cases the distance of the point of light from the ground is given — (not the height of the poles) —

In settling the distances between the poles we took into consideration the following calculation:

The illumination, at a point p: receives from a light on the top of a post, which is placed at the distance -a- from p- varies with the height x of the post so that:

amount of light = $\frac{\sin\alpha}{l^2}$ — (1)

As $\sin\alpha = \frac{x}{l}$ and $l = \sqrt{a^2+x^2}$; the expression (1) = $\frac{x}{(a^2+x^2)^{\frac{3}{2}}}$ —

This differentiated gives $\frac{(a^2+x^2)^{\frac{1}{2}}(a^2-2x^2)}{(a^2+x^2)^3}$ (2)

(2) has to be = 0 to indicate a max: which can only be, when $a^2 = 2x^2$ —

In our case x was given (= 90 feet) and -a- was equal to half the distance between two poles = d —

Therefore the distance between two poles, which place the source of light at the height -h- above the ground should be:

$d = h\sqrt{6} = 2{\cdot}828\,h$

in order that the points half way between the two poles receive the max: illumination —

This formula was of course not rigidly adhered to, but it served as a guide, when we selected the position of the successive lights with reference to the others and to each other —

It is possible that we have some further records at our works and if you want more information I will have them looked up —

A. P. Trotter, Esq.,
44, Chapel-ash Place,
Wells,
Somerset.

Yours faithfully,
Alex Siemens
W.

A.P.L.E. Conference

Opening Speech by the Minister of Transport

The opening speech at the A.P.L.E. Conference on September 10 was made by the Rt. Hon. Alfred Barnes, M.P., Minister of Transport. The Minister opened by saying that as the Ministry of Transport had now become the central authority responsible for street lighting, it was not inappropriate that he should address the opening meeting of the conference, to which, he understood, over 1,000 delegates had been appointed, representing 533 local authorities from all over the country.

The Minister reviewed the past activities of the Association, recalling that it was formed in London 23 years ago by a small band of enthusiastic lighting engineers who were anxious to see an improvement in the lighting of our highways. He had only recently assumed responsibility for street lighting, and it was too early to say on what lines policy would be developed during the coming years. He was, however, impressed with the view that there should be the greatest possible degree of uniformity in the standards of street lighting, and that wherever street lighting is provided it should be to approved standards.

He regarded it as a matter of interest that the Association is a professional body of men, representing rival interests, who meet together in friendly rivalry for the sole purpose of helping each other in the common interest of improving street lighting for the safety of all road users. The aim of all present was to obtain the best possible lighting from any existing source, which was what he had in mind when referring to the need for uniformity in street lighting; not the use of one type of illuminant only, as good lighting can be provided in a variety of ways, the two important factors being the right amount of light and its proper use.

The Association had taken part in several Government inquiries concerned with the question of improvements in street lighting, and was represented on the Departmental Committee, set up in 1936, the reports of which have been of very great help to public lighting engineers in this country and abroad. Now that the Ministry is the central authority for street lighting he looked forward to still closer co-operation.

Not only should the standards of lighting be such as to ensure the safe use of our highways at night, but every endeavour should be made to prevent the installation of lighting apparatus detracting from the amenities of the roads. The Minister was glad to note that the Association was again taking active steps to encourage manufacturers in the production of street lamp columns of sound and pleasing design. A lamp column designed on the right lines need not be an eyesore and could be made attractive, and he hoped that those delegates who represented lighting authorities would consider requiring, as a condition of any contract which they might let, that the lamp columns to be adopted were of a type commended by the Royal Fine Arts Commission.

Referring to the need of improved street lighting as a step towards the reduction of accidents on the road at night, the Minister said that it was a matter of first importance that, whatever scheme of street lighting could be carried out either now or in the near future should, as far as practicable, fit in with the ultimate scheme of lighting which was necessary for the particular road in question. In other words, what money could be applied to street lighting improvements now should be used for the provision of good lighting of a small mileage of road rather than a large mileage of mediocre or poor lighting.

As the standard of street lighting is raised, the Minister added, it will be necessary to raise the standard of qualifications of the lighting engineer. The service of public lighting should, wherever possible, be placed in the hands of a fully qualified public lighting engineer as is the common practice among the larger lighting authorities. Where this has been done the standard of lighting has improved both in value and economy.

Finally, the Minister expressed his pleasure at being able to address the conference and declared the exhibition open.

Lighting in the Public Service

Summary of an Address by
Mr. W. N. C. Clinch, M.I.E.E.*
President, A.P.L.E.

Public lighting is a service which, like all services to the community, comes in for more criticism than congratulation.

From the days of link-boys to the present time, when radar is available for the navigation of shipping, is a far cry, but it is not as difficult for us to picture the gloom of those old London streets as it might have been had we not, twice in the past 30 years, experienced a long term during which public lighting was denied us. That absence of lighting has made the public "street lighting conscious" now that the limited amount of lighting is again permissible. The present restrictions are irksome and of questionable value when considered from the standpoint of the national good. If lives can be saved, burglaries reduced and moral standards raised by an improvement in the effectiveness of street lighting, is the small increase in coal consumption correctly weighed in the balance? Evil fears light, and lurks in dark corners. The sooner light is properly applied in our highways and byways during hours of darkness the sooner will there be an improvement in the road accident returns and reduction in the number of burglaries.

In progressive areas efforts have been made for a good many years to standardise public lighting equipment and design with the object of securing uniform standards of lighting for main roads and residential side streets respectively. The large number of public lighting authorities renders success very difficult. The majority of council officials are very mindful of the Ministry of Transport recommendations, but local preferences give rise to changes in spacing and colour or lantern design at many a district boundary. Many smaller councils, however willing, are unable to implement the recommendations because, although appreciating their importance, they have not the money at their disposal to pay for such standards of street lighting. Until the cost of lighting is aided by grants from national funds we are at a standstill in securing the measure of uniformity which is essential for public safety.

A life is irreplaceable and it should not be forgotten that 6,648 people lost their lives in street accidents and 226,711 people suffered injury from the same cause during the year 1938. It is the duty of those responsible for street lighting not to tie themselves too harshly to the cost, but rather to the safeguard which by their active interest can make possible the saving of lives. It is possible that one may argue negatively and express the view that the better the street lighting the more some of the public may tend to assume the opportunities to take risks in crossing the roadways. The responsibility for street accidents, however, does not in itself reflect only upon those responsible for street lighting. The actions of people are at times thoughtless and ill-considered; there should be greater consideration and thought by users of the footways and users of the roads. Thus, in the training which is under consideration, thought must be given to the habits and ways of people as well as to the consideration of technicalities. Although to the public it is difficult to explain the meaning of lumens, of mounting heights and of spacing, in due course technical differences will have resolved themselves and fuller attention will be directed towards the problems of the human element.

Public lighting does not only cover the lighting of traffic routes, but it also embraces the lighting of footways for more specific purposes, to make attractive the shops so that the interested public can view the displays therein with equal delight in June or December. There is a vast field for investigation here. It is hoped that full advantage would be taken of the opportunities for exchange of views which were afforded by the Conference, and that the services of the Association would be utilised by the Ministry of Transport in all matters associated with street lighting.

* Delivered to the A.P.L.E. Conference, September 10, 1946.

Public Lighting Administration

By E. C. LENNOX, M.I.E.E., F.I.E.S.*

The question has often been raised as to whether or not some form of "Central Administration" of public lighting would be beneficial to the community. The present administration of, and rating for, the undertaking of lighting of streets and roads in this country dates from the Lighting and Watching Act of 1833, which has been amended from time to time by the various Local Government Acts.

Generally speaking the larger authorities are well able to meet the full needs of the township, including adequate and often elaborate lighting of the traffic routes. The work is undertaken by a special Public Lighting Department to which is often attached a fully equipped laboratory to carry out the testing of lamps and equipment used in connection with the work. The smaller administrative areas, particularly the smaller urban districts and rural parishes, on the other hand, find great difficulty in raising sufficient money to undertake even inadequate lighting schemes. In these areas public lighting is generally under the guidance of the District Surveyor or the Clerk to the Council, whose duties include work in many directions and who wisely leave the details and maintenance of lighting schemes to the local electricity or gas undertaking.

Such points were the subject of recommendations made in the Final Report of the Ministry of Transport Departmental Committee on Street Lighting. As an example of the financial difficulties alone of attempting to provide lighting to the standard set up in this report it is estimated that the provision of Group A lighting on a certain traffic route passing through the areas of a number of local authorities would require an annual rate varying from 0.08 to 1.48 pence in the pound.

It is suggested that the time is opportune for the introduction of some form of central administration, in which connection it is pointed out that

(i) The amount of traffic on roadways is daily increasing and in a few years is fully expected to greatly exceed the pre-war figures.

(ii) The accident rate during the hours of darkness will rise with the increasing traffic,

(iii) The present method of rating street lighting has failed to produce adequate and uniform lighting on through routes in built-up areas,

and

(iv) revenue for provision of lighting should not be a parochial matter—such costs being surely the concern of all road users.

A central form of administration of this public service would be expected to result in

(i) an evening of the burden of cost,

(ii) a greatly improved general illumination of roadways and streets and an appropriate standard on traffic routes,

and

(iii) some form of control to ensure provision of only approved lighting schemes and their adequate maintenance.

An obvious method of setting up such an administration would be to apply to the provision and maintenance of street lighting the same practice as is carried out in respect to the provision and maintenance of the roads themselves. The cost of lighting would then become a matter for payment from national funds for the trunk roads, County or County Borough funds for the next most important roads, and parochial funds for the least important streets or roads, the provision and maintenance of lighting for the latter types of roadway being subject to the same grants as are now made by the Ministry of Transport in connection with road maintenance. One objection that might be raised against this proposal is that the richer authorities would find the cost of lighting a much less burden than that of the more rural administrative unit. An alternative procedure might be that the present administration obtain grants from a national source for the lighting of the administrative area, e.g., from the Road Fund set up some years ago to be administered for the construction and maintenance of adequate roads to meet the increasing traffic conditions.

* Summary of a paper read to the A.P.L.E., September 11, 1946.

The Quality of Street Lighting Installations

By P. CRAWFORD SUGG*

The physics of street lighting are now well understood and this, together with practical experience, has enabled the dimensional factors such as mounting height, etc., to be co-ordinated and satisfactory results obtained. These requirements have been set out in the B.S. Draft Specification on Street Lighting. There is, however, in this document one clause which reads:—

"*Light Output of Lantern. It is particularly emphasised that the light output of a lantern is no guide to its effectiveness,* and the luminous flux for 100 ft. length of road is not necessarily an indication of the *quality* of the lighting installation; it is used only as a general index of the amount of light to be provided." While the luminous flux per 100 ft. of road is of significance, experience has shown that it is a matter of the greatest difficulty to postulate any measurement which in itself is an appraisement of the effectiveness of the lighting.

Various aspects of the evaluation of the revealing power of street lighting installations have been dealt with by many competent physicists, but despite the most patient analysis it has so far proved impracticable to evolve a simple yardstick in terms of revealing power which takes account of all the conditions met with in practice.

To provide for the safety of road users we have to ensure that both the pedestrian and vehicle driver have adequate and comfortable vision, and that even under conditions of rain and fog they are still assisted as far as possible. The greater responsibility rests with the vehicle driver, who, for a considerable part of his driving, will be peering through a wet windscreen with a field of vision composed largely of various shades of grey and including bright light sources and their reflections. The pedestrian, who probably does not realise the impediment to vision of a windscreen, normally looks only a few feet ahead. Not only must all avoidable glare be limited, but the sources of light should distract as little as possible so that the eyes of road users will be working in the best conditions for good visibility at night.

With regard to the colour of the light, the driver or pedestrian proceeding along a road at night in white light can distinguish the colour of large objects, and it is open to doubt whether the whole picture can be conveyed as easily and as quickly to the brain by the medium of the neutral tones produced by monochromatic light. Natural colours may, in very low illuminations, appear as tones of grey, but they are still the tones which the eyes and brain automatically attach to the objects, and recognition is easier than under distorted colour conditions.

Recent improvements in the design of gas lighting units have not only yielded higher and more consistent performance but, by radical changes in construction, have provided fittings of completely modern and attractive appearance. A steady improvement in the source of light is also being fully utilised by efficient redirectional systems which give distribution of light in accordance with the requirements of the Draft Specification.

The Draft Specification permits the use of lanterns with a maximum loss of 30 per cent. of the light in an upward direction and a maximum depreciation in illumination of 50 per cent. The gas source, however, naturally directs the greater part of its light usefully into the lower hemisphere, and usually only 5 to 15 per cent. of the light is lost upwards. The maximum depreciation of light is limited to about 20 to 25 per cent., a figure which many gas companies undertake to maintain. Gas lighting is, therefore, penalised on the present total lumen basis by its own efficiency of distribution.

Gas street lighting equipment in the past was not noted for its artistic design, however efficient it may have been. Modern practice, however, demands lanterns of pleasing day-time appearance, and such changes in design that have been made are very often functional, easier maintenance and greater durability having been achieved at the same time.

* Summary of a paper read to the A.P.L.E., September 12, 1946.

The Public Lighting Engineer

By RONALD PARKER*

In this paper Mr. Parker made an attempt to draw up a scheme which would provide the basis for the organisation of a lighting department, and devoted part of the paper to proposals designed to give the smaller authorities most of the advantages of expert technical guidance and control of its public lighting which, at present, only the very large authorities can afford.

The Basic Organisation

The proposed basic organisation, said the author, is of a sufficiently flexible nature to allow of its application to any full-scale lighting department. In the case of relatively small lighting departments the functional requirements of the large one exist, though it may be necessary to combine sections. The whole department will be under the control of the Public Lighting Engineer. He *must* have final responsibility for it and be answerable to no one but the Committee of his Local Authority charged with street lighting matters for its conduct, that is to say, he must have Chief Official status. It is also necessary that he shall have no duties other than those directly related to street lighting.

He should be assisted by:—

(i) A technical section;
(ii) A workshops section;
(iii) A lamp lighting and cleaning section; and
(iv) An administrative section.

The detailed duties of these sections would be as follows:—

THE TECHNICAL SECTION

(a) To operate a properly equipped photometric laboratory;
(b) To assist the public lighting engineer in the detailed planning of lighting schemes;
(c) To supervise the workshop staff in the installation of such schemes;
(d) By street test and other means to ensure that all apparatus controlling the distribution of light is kept at its correct setting;
(e) To study all complaints received relating to faults in connection with illumination, mechanical, and electrical defects, and suggest steps for the prevention of any defects which are found to be of a recurring nature;
(f) To conduct routine tests, where considered desirable, of materials purchased;
(g) To examine new designs of apparatus submitted by manufacturers;
(h) To examine, and try out if thought desirable, new ideas for the application of light to the streets.

THE WORKSHOPS SECTION

The extent of the duties of the Workshops Section will depend upon local circumstances. As a minimum it would:—

(a) Instal all new lighting apparatus;
(b) Keep all lighting apparatus in a sound condition mechanically, electrically and as regards gas supply.

It may carry on other work directly connected with street lighting in accordance with policy or custom.

THE LAMP LIGHTING AND CLEANING SECTION

The functions of this section are:—

(a) To see that the street lamps are lit and extinguished on time. If there is complete central control of lighting and extinguishing operations, this function may be restricted to the criticism of operating times;
(b) To see that all lamps give their *full* light at *all* appropriate times, so far as it is in the section's power;
(c) To keep all glassware and fittings clean, and this includes the short periodic cleaning of gas burners and attachments through which gas must flow;
(d) To replace electric lamps, dis-

* Summary of a paper read to the A.P.L.E., September 11, 1946.

charge tubes, gas mantles and nozzles as required. (This is really an extension of function (b)).

THE ADMINISTRATIVE SECTION

The duties of the Administrative Section would be:—

(a) To conduct correspondence;

(b) To keep personnel records;

(c) To keep financial records, including the cost accounts;

(d) To keep, compile, and present statistics of all kinds;

(e) To arrange for supplies of materials;

(f) To supervise the keeping and issue of stores.

It is not to be understood that a hard and fast line should be drawn between sections, although it is a feature of good organisation that the executive lays down clear and concise guidance as to the division of responsibility between sections, and especially is this so between the technical and workshops sections in relation to new installations, and these two and the lamp lighting and cleaning section in regard to general maintenance.

Personnel and Training

The author then went on to discuss the organisation of lamp lighting and cleaning to some length, and in the final section dealt with personnel, their qualifications and training. The public lighting engineer must have executive and administrative ability, the intelligent application of which depends upon a wide general knowledge and a comprehensive rather than detailed knowledge of the immediate matters under the control of the executive. He must also have technical ability which is a combination of theoretical knowledge and the ability to apply that knowledge in practice. The former is obtained by study of the necessary subject matter and the latter by practical experience.

If public lighting engineering is to become nationally recognised as a profession it is very necessary that the training of persons entering it shall be systematic both in theory and practice, and that there shall be attainable at the end of training some nationally recognised status. It is not difficult for the student of public lighting engineering to find a means of acquiring the necessary theoretical knowledge, but it is difficult for him to obtain systematic practical experience, although the means are at present available in a number of places.

A scheme is of no value if the trainees have insufficient intelligence to absorb the training and have not a satisfactory background of general education. Generally speaking, trainees should be required to have had a secondary school education and should be able to produce documentary evidence of having achieved a high standard of work in subjects having a scientific bias.

The requirements of theoretical training may be summarised as follows: Physics of light production and control, and light measurement; application of light in general and in particular in streets; physiology of the eye and the reaction of the eye to certain phenomena; a study of the practical means of light generation; general principles of the distribution of electricity and gas, particularly for street lighting; direct, automatic, and remote control of street lighting; the practical design of lighting apparatus; engineering mathematics; technical drawing; commercial law; methods of machinery of business; cost accounting; statistical methods and local government organisation and procedure.

Mr. Parker concluded his paper with a "Postscript to Councillors," saying that the paper had been written on the assumption that there was room in the structure of local government for the public lighting expert. It was apparent that local authorities were becoming aware of the necessity for appointing full time street lighting engineers, but it was equally apparent that there was a regrettable lack of knowledge of the qualifications which should be sought in such officials. Early action was required to establish some hall-mark for the trained public lighting engineer, but it may be some years before this can be done. In the meantime, it was hoped that the remarks on training which had been made in the body of the paper would be of some assistance to local authorities should they be called upon to study the qualifications of a person claiming to be a public lighting engineer.

Experimental Applications of Tubular Fluorescent Lamps to Street Lighting

By

L. J. Davies, M.A., B.Sc., and W. D. Sinclair, M.I.E.E.*

In the period immediately before the war, street lighting research, and the number and extent of street lighting installations, constituted a rising tide of progress with which the enforced diversion of the recent years of blackout lighting forms an acute contrast. However, during these years the lamp engineer, by the very needs of the times, has been urged to develop several new varieties of lamps. The tubular fluorescent lamp, with all that it offers in shape, efficiency, colour and reliability, makes a challenging appeal for the most serious consideration. The results of the experiments so far carried out and described in the paper indicate that tubular fluorescent lamps can play an interesting and, maybe, a very important part in street lighting.

The details of construction and operation of the fluorescent lamp are well known, and of greater interest to the application now under consideration are questions of a special nature associated with street lighting problems. There may be some fears regarding cold weather starting. As the temperature of the lamp envelope falls the vapour pressure of the mercury also diminishes, and although a "starting" gas is provided, the ability to start depends, to some extent, upon the presence of mercury vapour, and thus cold weather may cause difficult starting. Very extensive tests have been carried out which show that no troubles should be experienced unless voltages and temperatures are abnormally low. If it becomes important to operate under lower temperatures or voltage conditions then circuit or lamp modifications would make this possible. A variation of 1 per cent. in the supply voltage gives a light output change of approximately 1 per cent., which compares favourably with 2.3 per cent. with a high-pressure mercury vapour lamp and 4 per cent. with an incandescent lamp. The variation with the sodium lamp is similar to that with the fluorescent lamp.

* Summary of a paper read to the A.P.L.E., September 12, 1946.

Lantern Design

With arterial road lighting the aim of the lighting engineer is to produce on the road surface and other backgrounds uniform levels of brightness, against which objects can be discerned as dark shapes against the bright backgrounds. Full use is made of maximum reflection characteristics of the roadway to achieve this end, and the light distribution of the lanterns employed is chosen so as to promote this effect.

The flux that provides the road brightness at some points will at others fall on the eyes of the user, and thus cause glare. The subject of glare is a complex one. The inherent low brightness of the fluorescent lamp is a most helpful feature in discomfort glare, as variation of source brightness influences this considerably. If many lamps of low brightness have to be used in order to get a great flux from a single lantern, the flashed area of the lantern increases, and the advantages gained by the use of the low brightness sources may be largely offset. Experience on the road is wanted on this point.

As far as the design of a lantern for high flux outputs is concerned, the position is as follows:—

A typical polar diagram of light distribution to produce the desired road surface and background brightness at wide spacing is one with peak intensities of the order of 5,000 candles. The highest intensity that can be obtained with anodised aluminium reflectors of practicable dimensions and using 80-watt fluorescent lamps is 1,500-1,800 candles.

In order to produce intensities of the

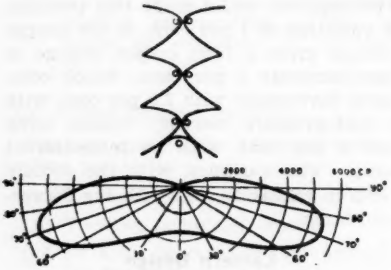


Fig. 1. Polar Diagram of seven-lamp lantern.

order 5,000 candles, a minimum of three fluorescent lamps in such individual reflectors would be required. This means for a complete fitting, therefore, a minimum of seven 80-watt fluorescent lamps, three in each direction to produce the main beams, and one situated beneath to fill in the distribution smoothly.

The polar diagram for such a lantern is shown in Fig. 1. The beam depth is considerable, as compared with the conventional high-power lantern using a horizontal burning linear lamp. Such a unit would consume approximately 700 watts, and with an efficiency of approximately 60 per cent. would have a light output of just about 12,000 lumens. A 5-lamp, 400-watts lantern is considered more practicable. Where the flow of traffic is heavy, as in shopping centres, the principles of silhouette vision cannot be fully used, as the background, roadway or path, etc., is partially or wholly obscured by the traffic. Also the capital value of a busy town centre permits of a de luxe system, and this and the many traffic intersections allow a closer spacing than 120-150 ft. to be appropriate. The lantern distribution required is therefore different, and experiment shows that it can be obtained by the use of three 80-watt lamps.

Three 80-watt tubular lamps arranged in the optical system are shown in Fig. 2. This combination was designed to give a good light distribution, with lantern spacings of 80 to 100 ft. in mind, at

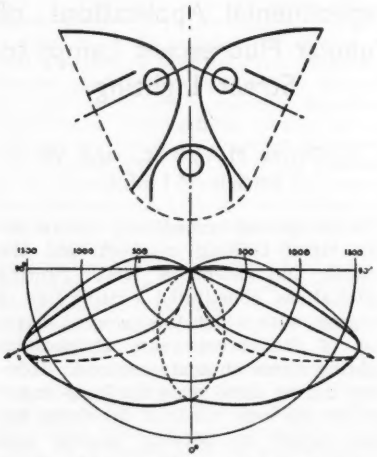


Fig. 2. Polar diagram of three 80 watt lanterns.

a mounting height of 25 ft. The manner in which the individual reflectors contribute towards the complete distribution is illustrated clearly. Attention is called to the use of " anti-glare " shields to modify the normal parabolic distribution. It will be apparent that the light striking the underside of the glare shield is redirected to the roadway at a useful point. This feature is the basis for obtaining a controlled cut-off distribution. The distribution in the cone containing the main beam is symmetrical. The wide beam spread is not an undesirable effect as kerbs, pathways, and the faces of buildings are well illuminated and enable a good visibility to be maintained at the roadside—a zone of potential danger.

Practical Requirements

The lantern has other interesting features, as follows: Briefly, it is self-contained, chokes, starters, and P.F. capacitors being built in. Access to one end only is required for relamping and starter replacement. The fitting is weatherproof with a plastic enclosure easily removed for cleaning purposes by the operation of a toggle catch. All the

anodised aluminium reflectors are located in cast frames with both internal and external profile supports. This ensures that the mirror form is satisfactorily maintained. The alloy supports, together with the main tubular spar, to which they are attached, form the framework of the whole structure. The roof structure and plastic enclosure are carried by this chassis and a light, strong fitting results. Gaskets together with a very substantial deep beading ensure that the fitting is watertight. The

Fig. 3. Trial installation by night.

weight of this fitting, together with three chokes, P.F. correction capacitors, starters, etc., is about 65 lb.

There are several practical methods of mounting fittings of this size and weight above the roadway. The standard steel or concrete column is well able to support a lantern of this weight provided the overhang is not excessive. When this type of mounting is employed the fitting is arranged for top-entry. It is suggested that for built-up areas, to which this type of lighting is perhaps most applicable, full use of the buildings for lantern mounting merits close

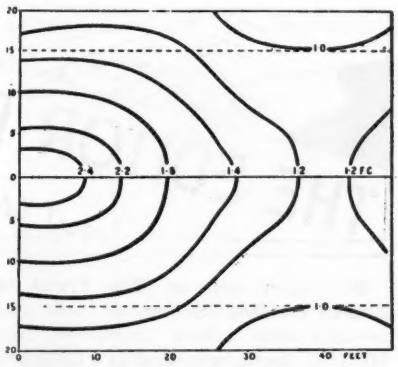


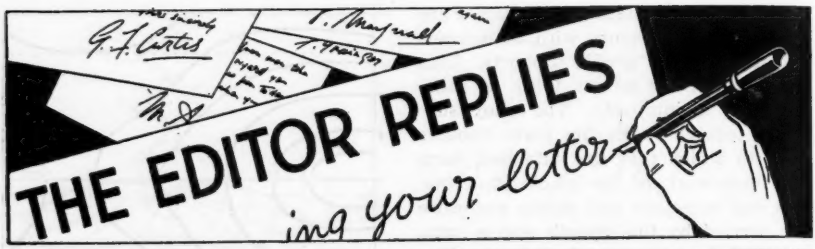
Fig. 4. Iso-foot-candle diagram of trial installation.

attention, either from the building face by suitable brackets, possible only with narrow pavements, or on a wire span system between buildings on opposite sides of the street. The elimination of poles in narrow and busy thoroughfares is obviously a good point, and it will be of interest to have public lighting engineers' views.

Conclusions

The results indicate that for town centres, traffic areas, deliberately selected for the first intallation tests, and taking into consideration the excellent overall effect that will be obtainable when shops, in all probability illuminated internally and in their windows with the same type of lamps, add a harmonising quota, a new type of street lighting is created by the fluorescent lamp. It is probable that costs of installations will be higher than alternative systems, but not necessarily prohibitive, taking into consideration the superior results obtained.

Open-air tests for many months of large and small experimental lanterns indicate no undue problems of weathering or maintenance.



Our recent note on **The Trend of Church Lighting** (September, 1946) has brought some further comments from Mr. L. C. Rettig, who send us a summary of a lecture on this subject recently delivered by him to the I.E.S., Bath and Bristol Centre. He remarks on the great variety of conditions met in this country, where the practice of lighting churches by means of lanterns suspended from the roof is by no means general.

Mr. Rettig also discusses the problem of **pulpit lighting,** a rather awkward one. He is, however, satisfied that the method of lighting by a single projector placed at an angle of 45 deg. above the speaker's head is not a satisfactory one. In order to avoid distorting shadows, two or more projectors, he suggests, are essential.

Mr. P. J. Waldram has favoured us with another letter bearing on **The Basis of Daylight Measurements.** After alluding to Mr. Allen's "thoughtfully suggestive paper" in the September number of the I.E.S. Transactions, he remarks that both the B.R.S. and the N.P.L. tables of window efficiency involve a material degree of approximation. For example, no provision is made for the discounts due to the use of various special glasses or the lateral obstruction by glazing bars "en echelon." There is also the point that in order to overcome difficulties caused by the varying distance of external obstructions, such obstructions are refined only by angular elevation. Mr. Waldram gives examples of obstructions which would thus be rated on the same basis though different in effect. Finally, he suggests that an informed discussion on **fenestration in the design of post-war buildings** would be of considerable value at the present time.

In the pursuit of **fuel economy** there has always been a tendency for lighting to suffer, for the reason that any curtailment in lighting makes an appeal to the eye and may therefore be assessed by the public mind as very much more effective in fuel saving than it actually is. I have always considered **the cutting down of street lighting** a case in point. It is interesting, therefore, to note the statement that London's 27 boroughs have been advised by their Standing Committee *not* to turn out all street lamps at midnight. The committee quoted the Metropolitan Management Act of 1855, which imposes "a positive duty to light the streets," and suggested leaving on one lamp out of two.

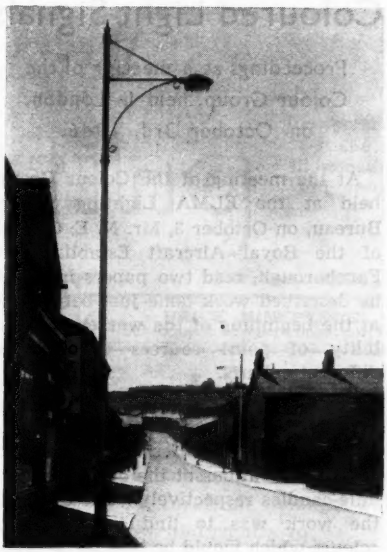
The prohibition of all luminous signs and **shop window lighting** during the winter season also bears hard both on merchants and the public. It has been repeatedly stated that no relaxation is contemplated, even during the Christmas season. Recently, however, a faint hope has been expressed by the National Chamber of Trade that some relaxation in regard to window lighting may be permitted during the week preceding Christmas. Let us hope.

Fluorescent Lighting in a Cotton Mill

Below will be found a picture of the cotton spinning room at Dart Mill, Ltd. (Bolton), where 286 5-ft. 80-W. fluorescent lamps in Revo "Trufolite" reflectors have been installed. The soft and

well diffused lighting is enhanced by the system of decoration—white ceiling and cream walls—and similar conditions have been provided in the carding room. The reflectors were manufactured and supplied by Revo Electric, Ltd. (Tipton, Staffs), and the installation was planned and executed, in conjunction with Dart Mill, Ltd., by the Electrical Equipment Co. (Leicester), Ltd.

Street Lighting in Blackburn



Courtesy; Blackburn Corporation Electricity Dept.

This picture shows a street in Blackburn where Metrovick "Trafford" lanterns and equipment have recently been installed by the Corporation. The fitting comprises a one-piece bowl refractor lantern, using a horizontally burning mercury discharge lamp.

SITUATIONS WANTED

ELECTRICAL ENGINEER, aged 30, graduate I.E.E., and ex-S/Sgt. R.E.M.E., desires post in the Lighting Industry in the south-western area. Fully experienced in maintenance work of all types of light motors, lighting equipment, and domestic electrical appliances. Particularly interested in research work. Technical photography of components, assemblies, and workshop lay-outs a speciality. —Write Box 759, "Light and Lighting," 32, Victoria-street, London, S.W.1.

Ex - R.A.F. WARRANT OFFICER FLIGHT ENGINEER, public school education—National Certificate in Electrical Engineering—six years with lighting firms in laboratory, planning departments, and technical representative, seeks situation.—Write Box 760, "Light and Lighting," 32, Victoria - street, London, S.W.1.

SITUATION VACANT

LAMP PRODUCTION ENGINEER.—A vacancy exists in a North of England factory for a lamp production engineer with wide experience in the manufacture of all classes of electric lamps. Only applicants with the right experience need apply, giving full details, references, and salary required.—Box 753, "Light and Lighting," 32, Victoria-street, London, S.W.1.

The Recognition of Coloured Light Signals

Proceedings at a meeting of the Colour Group, held in London, on October 3rd, 1946.

At the meeting of the Colour Group, held at the ELMA Lighting Service Bureau, on October 3, Mr. N. E. G. Hill, of the Royal Aircraft Establishment, Farnborough, read two papers in which he described work done just before and at the beginning of the war on the visibility of point sources of light of different colours.

The first paper dealt with the recognition of the colour of point sources of light having intensities such as to produce illuminations at the eye of 1 and 2 mile-candles respectively. The object of the work was to find the range of colours which would be best for aviation signals. A series of 17 colour filters were used to give, by dilution with different proportions of white, a range of 73 colours and these were viewed by binocular foveal vision against a black background. Nine subjects with normal colour vision made the observations under conditions of dark adaptation, and the results were plotted on the XY colour diagram as lines of equal percentages of correct placing of the colours in one of the four groups red, yellow+orange, green+blue, white. It was found that yellow-orange was the least satisfactory colour for certain recognition in a signal of low intensity; in fact, Mr. Hill said that it did not seem possible to have four colours which could be distinguished with reasonable certainty. The three colours red, white, and blue-green were, however, quite satisfactory, especially if the range of colour temperatures admitted as white was somewhat shorter than that at present used for "aviation white." The suggestion was made in the paper that no colour temperature lower than about 2,600°K (x=0.47) should be used, and this would ensure that there was no confusion with yellow-orange. In the subsequent discussion Mr. J. G. Holmes said that it was difficult not to admit colour temperatures down to 2,300°K because of the necessity for using oil flames as sources.

The second paper described an extensive series of observations on coloured light signals seen against white backgrounds of brightnesses ranging from less than that of the starlit sky to that of a clear noon sky 20° from the sun. White, yellow, red, and green signals were observed by monocular foveal vision and two thresholds were determined, viz.: (a) the threshold for detection of the presence of a signal, irrespective of its colour, and (b) the threshold for colour recognition. In both cases, the criterion used was that of 50 per cent. correct answers. It was estimated that the threshold for reasonable certainty of recognition would be some three to five times that found for the 50 per cent. criterion. Again it was found that yellow was a comparatively unsatisfactory colour at both very low and very high background brightnesses.

A very interesting discussion took place after the reading of the papers. Dr. W. D. Wright said that it had been established that at the centre of the fovea, colour vision seemed to be similar to that of a person in whom the blue-sensitive receptor was lacking. This would explain why Mr. Hill had found it necessary to treat blue and green as a single colour class. It would also explain the tendency to confusion between yellow-orange and red and the presence of a region of yellow between the white and purple, a phenomenon to which Mr. Holmes had referred. It is understood that the papers are to be published in the Proceedings of the Physical Society.